

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application. The following listing provides the amended claims with deleted material crossed out and new material underlined to show the changes made.

1. (Currently Amended) A method of quantizing a particular macroblock of a particular frame in a sequence of digital video frames, the particular frame having a frame type, said method comprising:

determining a buffer occupancy accumulator for the particular frame as a difference between an actual amount of bits used to encode a previous frame having the same frame type as the particular frame and a requested amount of bits for the previous frame having the same frame type as the particular frame;

limiting an amount of change in said buffer occupancy accumulator based upon the frame type; and

encoding said particular macroblock using a quantizer value computed based on said buffer occupancy accumulator,

wherein the determining, limiting, and encoding are performed by an encoder.

2. (Canceled)

3. (Currently Amended) The method of claim 1, wherein said limiting ~~on~~ the amount of change in said buffer occupancy accumulator is performed by clipping said buffer occupancy accumulator with respect to ~~the~~ a target number of bits of the particular frame.

4. (Currently Amended) The method of claim 1, wherein said limiting ~~on~~ the amount of change in said buffer occupancy accumulator is performed by scaling said buffer occupancy accumulator with respect to ~~the~~ a target number of bits of the particular frame.

5-6. (Canceled)

7. (Currently Amended) The method of claim 39, wherein the scaling function is a function of a position of the particular macroblock within the particular frame.

8. (Currently Amended) The method of claim 39, wherein the scaling function is a function of bits per pixel of the particular frame.

9. (Canceled)

10. (Currently Amended) The method of claim ~~5~~ 39, wherein said number of bits that should have been used is calculated in a manner that takes into account macroblock coding methods.

11. (Currently Amended) The method of claim ~~5~~ 39, wherein said quantizer adjustment is further based on a Normalized Sum of Absolute Differences (NSAD).

12. (Currently Amended) The method of claim ~~5~~ 39, wherein said quantizer adjustment is further based on a macroblock activity measure normalization (mbactN).

13. (Currently Amended) The method of claim ~~5~~ 39, wherein determining ~~a~~ the base quantizer value comprises clipping said base quantizer value to produce an adaptively determined finite range.

14-15. (Canceled)

16. (Currently Amended) A computer readable medium storing a computer program which when executed by a processor quantizes a particular macroblock of a particular frame in a sequence of digital video frames, the particular frame having a frame type, the computer program comprising sets of instructions for:

determining a buffer occupancy accumulator for the particular frame as a difference between an actual amount of bits used to encode a previous frame having the same frame type as the particular frame and a requested amount of bits for the previous frame having the same frame type as the particular frame;

limiting an amount of change in said buffer occupancy accumulator based upon the frame type; and

encoding said particular macroblock using a quantizer value computed based on said buffer occupancy accumulator.

17. (Canceled)

18. (Currently Amended) The computer readable medium of claim 16, wherein said limiting ~~an~~ the amount of change in said buffer occupancy accumulator is performed by clipping said buffer occupancy accumulator.

19. (Currently Amended) The computer readable medium of claim 16, wherein said limiting ~~an~~ the amount of change in said buffer occupancy accumulator is performed by scaling said buffer occupancy accumulator.

20-31. (Canceled)

32. (Previously Presented) The method of claim 1, wherein the frame type is one of an intra-frame encoded and an inter-frame encoded.

33. (Previously Canceled)

34. (Currently Amended) The method of claim ~~14~~ 42, wherein the frame type is one of an intra-frame encoded and an inter-frame encoded.

35. (Previously Presented) The computer readable medium of claim 16, wherein the frame type is one of an intra-frame encoded and an inter-frame encoded.

36. (Canceled)

37. (Currently Amended) The method of claim 1, wherein limiting the amount of change in the buffer occupancy accumulator comprises limiting the change to a particular percentage of a value of the buffer occupancy accumulator from the previous frame having the same frame type as the particular frame.

38. (Currently Amended) The method of claim 39, wherein the macroblock coding method is one of intra-macroblock and non-intra-macroblock.

39. (Currently Amended) ~~The method of claim 5~~ A method of quantizing a particular macroblock of a particular frame in a sequence of digital video frames, said method comprising:

determining a base quantizer value;

determining a ~~wherein the~~ quantizer adjustment is based ~~upon~~ on multiplying ~~the~~ a scaling function by (i) ~~a~~ the difference between ~~a~~ the number of bits actually used to encode previous macroblocks of the particular frame and ~~a~~ the number of bits that should have been used to encode previous macroblocks of the particular frame[[,]] and (ii) a normalized activity level of the particular macroblock, wherein the scaling function is different for different macroblock coding methods; and

encoding said particular macroblock based on a quantizer value computed as a sum of the base quantizer value and the quantizer adjustment,

wherein determining the base quantizer value, determining the quantizer adjustment, and encoding are performed by an encoder.

40. (Currently Amended) The method of claim 44 42, wherein the first frame type includes motion compensated macroblocks, and the first formula is based on a normalized sum of absolute differences that allocates more bits for the particular frame when a motion compensated residual for the macroblocks is more complex.

41. (Currently Amended) The method of claim 44 42, wherein the second frame type does not include motion compensated macroblocks, wherein the second formula is based on a normalized macroblock activity measure that allocates more bits for the particular frame if the macroblock activity is smaller.

42. (Currently Amended) ~~The method of claim 14~~ A method of determining a quantizer value for quantizing a particular macroblock of a particular frame in a sequence of digital video frames, said method comprising:

when the particular frame is a first frame type, computing a number of bits that should have been used to encode all previously encoded macroblocks of the particular frame by using a first formula;

when the particular frame is a second frame type, computing the number of bits that should have been used to encode all previously encoded macroblocks of the particular frame by using a second formula;

determining a delta value comprising a difference between a number of bits actually used to encode all previous macroblocks of the frame and the computed number of bits that should have been used; and

quantizing said particular macroblock using a quantizer value computed as a sum of a base quantizer value and a quantizer adjustment, said quantizer adjustment computed by multiplying (i) the determined delta value, (ii) a scaling function that is different for different macroblock coding methods, and (iii) a normalized activity level of the particular macroblock,

wherein the computing, determining, and quantizing are performed by an encoder.

43. (Currently Amended) The method of claim 9 42, wherein the scaling function is a function of a number of macroblocks in the particular frame.